



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/607,612	06/27/2003	Helene Del Puppo	LAM2P413	8025

7590

04/19/2006

Michael L. Gencarella, Esq.

Martine & Penilla, LLP.

Suite 170

710 Lakeway Drive

Sunnyvale, CA 94085

EXAMINER

TRAN, BINH X

ART UNIT

PAPER NUMBER

1765

DATE MAILED: 04/19/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

24

Office Action Summary	Application No. 10/607,612	Applicant(s) PUPPO ET AL	
	Examiner Binh X. Tran	Art Unit 1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 22 March 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,4-12,14,19,21,22,24 and 28-30 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,5-12,14,19,21,22,24 and 28-30 is/are rejected.
- 7) ☒ Claim(s) 4,14,24 and 30 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Response to Amendment

1. This office action is responsive to the amendment filed on 3-22-2006. The examiner decides to withdraw the finality of the previous office action mailed on 1-26-2006 because the examiner inadvertently misread the Yoshida's reference with respect to claims 1, 4, 6 (See applicant's remark in page 8 for further detail). However, upon further consideration, the examiner provides a new ground of rejection as discussed below.

Claim Objections

2. Claims 14, 24 and 30 are objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form.

Claim 14 depends on claim 12. In claim 12, applicants use the Markush group (i.e. "selected from the group consisting of") to recites alternative limitation for the silicon containing gas. According to the MPEP 2173.05(h), Markush group sanctions claiming a genus expressed as a group consisting of certain specified materials. The Markush group must be used which the transitional phrase "consisting of". It is improper to use the term "comprising" (or including) instead of "consisting of." (See MPEP 2173.05(h)). According to MPEP 2111.03, "the court noted the phrase "group consisting of" is a closed term, which is often used in claim drafting to signal a "Markush group" that is by

Art Unit: 1765

its nature closed". However, in the dependent claim 14, applicants try to open the Markush group by using open-end language (i.e. "the group further includes SiF₄").

In claims 24, 30, applicants also try to open the Markush group by insert multiple gas into the Markush group using open-end language.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 28-29 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 28 and 29 recites the limitation "'the source" in claim 19. There is insufficient antecedent basis for this limitation in the claim.

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

6. Claim 9 is rejected under 35 U.S.C. 102(e) as being anticipated by Brown et al. (US 6,703,269).

Respect to claim 9, Brown discloses a method for etching a substrate comprising:

striking a plasma in a chamber;

etching a dual doped gate structure, wherein the dual doped gate structure includes an n-doped polysilicon gate (32) and p-doped polysilicon gate (33), wherein the n-doped polysilicon gate and the p-doped polysilicon gate are contemporaneously etched (Fig 3-4, col. 5-6).

forming a passivation layer (50) from byproducts generated from the etching (col. 6 lines 38-53, Fig 5);

enhancing the passivation layer (50) (See Fig 6-7).

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to

Art Unit: 1765

consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

9. Claims 1, 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chang et al. (US 5,670,397) in view of Shishiguchi (US 5,773,357).

Respect to claims 1, Chang discloses a method for etching a polysilicon gate structure in a plasma chamber comprising the steps of:

defining a pattern (resist mask layer 14) protecting a polysilicon film (12: 12a and 12b) to be etch (fig 3, col. 4 lines 1-10);

striking a plasma;

etching substantially all of the polysilicon film (12b) that is unprotected (col. 4);

introducing a silicon containing gas (i.e. SiCl_4) (col. 4 lines 35-38);

etching a remainder of the polysilicon film (12a) while introducing a silicon containing gas (col. 4 lines 34-46, Fig 4).

Chang fails to disclose the silicon containing gas is selected from the group consisting of SiH_3CH_3 , $\text{SiH}(\text{CH}_3)_3$, SiHCl_3 , and TEOS at the flow rate greater than 25 sccm. However, Chang clearly teaches to use silicon-containing gas SiCl_4 . Shishiguchi teaches to use SiCl_4 , SiH_4 , SiHCl_3 (col. 5 lines 51-60, col. 6 lines 65-67). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Chang in view of Shishiguchi by using SiHCl_3 equivalent and substitution of one for the other would produce an expected result.

Claim 1 differs from Chang by further the specific flow rate of silicon containing gas. However, Shishiguchi discloses the flow rate of the silicon containing gas is a

Art Unit: 1765

result effective variable by varying between 500-1000 sccm (Fig 2-3, read on applicant's range of greater than 25 sccm). Since, Shishiguchi clearly teaches to it is possible to replace SiH_4 with SiHCl_3 , the examiner will interpret that Shishiguchi also teaches to vary the flow rate of SiHCl_3 as a result effective variable. The result effective variable is commonly determined by routine experiment. The process of conducting routine experiments so as to produce an expected result is obvious to one of ordinary skill in the art. Hence, it would have been obvious to one having ordinary skill in the art, at the time of invention, to perform routine experiments to obtain optimal flow rate of silicon containing gas as an expected result.

Respect to claim 6, Chang discloses preventing notching at a base of the polysilicon gate structure (See Fig 4).

10. Claims 1, 6, 8, 10-12, 19, 28, 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Brown in view of Shishiguchi (US 5,773,357).

Respect to claims 1, Brown discloses a method for etching a polysilicon gate structure in a plasma chamber comprising the steps of:

defining a pattern (16) protecting a polysilicon film (34, 32, 33, 30) to be etch (fig 3);

striking a plasma;

etching substantially all of the polysilicon film (34, 32, 33) that is unprotected (Fig 4, col. 5 lines 45-67);

forming a passivation layer (50) in situ in the etching chamber;

Art Unit: 1765

etching a remainder of the polysilicon film (30) while having the passivation layer (50) protect the sidewall of the gate structure (Fig 6-7).

Respect to claim 1 and 10, Brown fails to disclose the sep of introducing the silicon containing gas is selected from the group consisting of SiH_3CH_3 , $\text{SiH}(\text{CH}_3)_3$, SiHCl_3 , and TEOS at the flow rate greater than 25 sccm. However, Brown teaches to use Cl_2 as an etching gas (col. 6 lines 60-65). Shishiguchi teaches to flow silicon-containing gas while introducing the Cl_2 etchant gas to form thin layer (19) (col. 5 lines 23-35). Shishiguchi further teaches to use SiCl_4 , SiH_4 , or SiHCl_3 as a silicon containing gas (col. 5 lines 51-60, col. 6 lines 65-67). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Brown in view of Shishiguchi by introducing silicon containing gas including SiHCl_3 while because it will enhance the forming of the thin film passivation layer.

Claim 1 differs from Brown by further the specific flow rate of silicon containing gas. However, Shishiguchi discloses the flow rate of the silicon containing gas is a result effective variable by varying between 500-1000 sccm (Fig 2-3, read on applicant's range of greater than 25 sccm). Since, Shishiguchi clearly teaches to it is possible to replace SiH_4 with SiHCl_3 , the examiner will interpret that Shishiguchi also teaches to varying the flow rate of SiHCl_3 as a result effective variable. The result effective variable is commonly determined by routine experiment. The process of conducting routine experiments so as to produce an expected result is obvious to one of ordinary skill in the art. Hence, it would have been obvious to one having ordinary skill in the art, at the

time of invention, to perform routine experiments to obtain optimal flow rate of silicon containing gas as an expected result.

Respect to claim 6, Brown discloses preventing notching at a base of the polysilicon gate structure (See Fig 7). Respect to claim 8, Brown teaches to form a passivation layer (50) from byproducts of generated from the etching of the polysilicon film. The limitation of claims 11-12 has been discussed above. Respect to claims 19 and 28, Brown discloses the step of depositing a layer of silicon containing oxide (50) over a gate oxide (18) as the substrate is being etch using O₂ gas (col. 6 lines 40-47). Respect to claim 30, Shishiguchi discloses the silicon containing gases is selected from the group consisting of SiCl₄, SiHCl₃ (col. 6 lines 65-67).

11. Claims 5, 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Brown and Shishiguchi as applied to claim 1 above, and further in view of Chow et al. (US 6,872,322).

Respect to claim 5, Brown and Shishiguchi fails to disclose the step of executing a first etch to remove a hard mask. However, Brown clearly teaches the step of patterning or removing a portion of the mask to create a pattern (16) and the step of etching the polysilicon to create a gate structure. Chow teaches to execute an etching step to remove a hard mask (i.e. nitride mask) and execute another etch step to remove the polysilicon film (24) that is unprotected (col. 13-14; Table 1-2). Chow further discloses it is possible to use photoresist or a hard mask for the mask layer (col. 12 lines 52-55). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Brown and Shishiguchi in view of Chow by using the hard

Art Unit: 1765

mask because equivalent and substitution of one for the other would produce an expected result. Further the hard mask layer will protect the underlying polysilicon layer during the etching process to create a gate structure.

Respect to claim 7, Brown teaches to terminate the etching of the polysilicon film that is unprotected when the substrate is exposed. However, Brown fail to disclose the overetch process. Chow teaches to terminate the etching of the polysilicon film that is unprotected (i.e. terminating the main etch process) and striking an over etch plasma to completely remove all polysilicon layer that is unprotected (Table 1-2, Fig 4-5). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Brown and Shishiguchi in view of Chow by performing an over etch process because it will completely remove all polysilicon layer that is unprotected.

12. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Brown in view of Shishiguchi as applied to claim 12 above, and further in view of Yoshida.

Respect to claim 14, Becker and Shishiguchi fail to disclose SiF_4 gas. However, Shishiguchi clearly disclose to use SiCl_4 gas. Yoshida teaches to use SiCl_4 or SiF_4 as a silicon containing gas (col. 5 lines 35-40). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Brown and Shishiguchi in view of Yoshida by using SiF_4 gas because equivalent and substitution of one for the other would produce an expected result.

13. Claims 19, 21-22, 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Becker (US 5,904,712) in view of Shishiguchi.

Respect to claim 19, Becker discloses a method for enhancing polysilicon (13) to oxide (14) selectivity during an etching process, comprising:

providing a substrate to be plasma etched in a chamber;

striking a plasma in the chamber (col. 8 lines 51-67);

flowing a silicon containing gas (i.e. SiCl_4) into the chamber while performing an over etch step of the etching process (col. 8 lines 60-62)

depositing a layer of a silicon containing oxide over a gate oxide (14) as the substrate is being etched (col. 9 lines 1-13, col. 10 lines 25-30).

Becker fails to disclose the silicon containing gas is selected from the group consisting of SiH_3CH_3 , $\text{SiH}(\text{CH}_3)_3$ and SiHCl_3 , and TEOS. However, Becker clearly teaches to use silicon-containing gas SiCl_4 . Shishiguchi teaches to use SiCl_4 , SiH_4 , or SiHCl_3 (col. 5 lines 51-60, col. 6 lines 65-67). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Chang in view of Shishiguchi by using SiHCl_3 equivalent and substitution of one for the other would produce an expected result.

Respect to claims 21, 22, Becker discloses depositing a SiO_2 over a gate oxide (14) as the substrate being etched during the over etch step, this causes a polysilicon to oxide selectivity to increase so as to prevent any etching of the gate oxide (Fig 4, col. 9 lines 2-13). Respect to claim, 28, Becker teaches to provide O_2 from an oxygen gas feed source (from He/O_2 source) for forming the SiO_2 (col. 9 lines 3-10, col. 10 lines 25-30).

Art Unit: 1765

14. Claim 24 is rejected under 35 U.S.C. 103(a) as being unpatentable over Becker in view of Shishiguchi as applied to claim 19 above, and further in view of Yoshida.

Respect to claim 24, Becker and Shishiguchi fails to disclose SiF₄ gas. However, Becker and Shishiguchi clearly disclose to use SiCl₄ gas. Yoshida teaches to use SiCl₄ or SiF₄ as a silicon containing gas (col. 5 lines 35-40). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Becker and Shishiguchi in view of Yoshida by using SiF₄ gas because equivalent and substitution of one for the other would produce an expected result.

Allowable Subject Matter

15. Claim 4 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

16. Claim 29 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, 2nd paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

17. The following is a statement of reasons for the indication of allowable subject matter: The cited prior arts fail to disclose the following limitation in conjunction with all other limitation in the claims: the silicon containing gas originates from a solid source of silicon introduced to the plasma etch chamber (claim 4); or the source is an oxygen containing solid material selected from the group consisting of quartz and aluminum oxide.

Response to Arguments

18. Applicant's arguments that "Yoshida fails to teach or suggest "introducing a silicon containing gas at a flow rate greater than 25 standard cubic centimeters per minute (sccm)" is persuasive. Therefore, the previous ground rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made as discussed above. Respect to claim 19, 21-22 and 28, the applicants amendment is sufficient to over the examiner previous rejection under 35 USC 102(b) as being anticipated by Becker et al. However, upon further consideration, a new grounds of rejection is made as discussed above.

Conclusion

19. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Art Unit: 1765

20. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Binh X. Tran whose telephone number is (571) 272-1469. The examiner can normally be reached on Monday-Thursday and every other Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on (571) 272-1465. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Binh X. Tran

NADINE G. NORTON
SUPERVISORY PATENT EXAMINER

